tubercle bacilli were detected and in 5 of these guinea-pig inoculation confirmed the diagnosis. In 4 cases, tubercles of the choroid were seen. In 7 demonstrable tuberculosis elsewhere was noted.

In view of the fact that recovery can take place in perhaps 1 in 200 cases, steps should be undertaken actively to facilitate such a possibility. The patient should be put in a quiet, airy, dark place and kept as free from annoyance as possible. Lumbar puncture should be performed at once. The writer had a case, a boy, aged five years, from whose spine 40 c.c. of fluid were removed every other day for two weeks, with marked amelioration in the symptoms. Forced feeding through nasal tube, with milk and eggs, should be done. Morphine administered for pain and as a sedative, if respiration is not embarrassed thereby, and because free formaldehyde is found in the spinal fluid after the ingestion of urotropin the latter drug should be given freely. I have found, after giving it for one day, that formaldehyde can be detected in the fluid with iron and sulphuric acid; and because Raw has reported recovery in two cases in which tuberculin was used, I would advocate one or two injections of this remedy.

One case was most skilfully operated on by Dr. George Müller, who decompressed and punctured the left lateral ventricle, withdrawing about four times the normal amount of fluid, the child ultimately dying of respiratory palsy, having lived for three weeks after the diagnosis had been made and gaining five pounds by forced feeding. Why decompression is not fraught with better results in this disease is probably due to the involvement of the ventricles. The unrelieved distention is due to the choking of the canal leading from the third to the fourth ventricle.

AN INTENSIVE STUDY OF THE EPIDEMIOLOGY OF PELLAGRA. REPORT OF PROGRESS.[1]

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Part I.

I. General Plan of the Work. Although the Thompson-McFadden Pellagra Commission will continue its work in the field during 1913, it is considered advisable and warranted to set forth at this time in a brief preliminary report certain results of the epidemiological study made in 1912.

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[1] From the Thompson-McFadden Pellagra Commission, New York Post-Graduate Medical School and Hospital.

It was decided that an intensive study of the disease as it occurred among the population of a limited area would yield more valuable epidemiological information than a more superficial investigation over an extended area, conducted by correspondence and by brief studies in a number of different localities. No such intensive epidemiological study within a small area seems to have been previously undertaken in pellagra, while much data gathered by the more general methods are already available in the literature.

For the collection of data a blank booklet was prepared, covering points considered of possible significance regarding the patients themselves, their families, their residences, and the neighborhood in which they lived. In order to secure these data, each patient was visited one or more times in his or her own home.

In this preliminary report only summarized data will be included. The detailed epidemiological data for each case, and certain more intensive studies made in selected localities within the county, will appear in the report to be issued on completion of the investigation.

The problem immediately before the commission in all its work was the etiology of pellagra and not its symptomatology or therapeutics, except as these subjects might throw light upon the essential nature of the disease. In view of the essential importance of diagnosis in our work, the conservative position was taken that a positive diagnosis would be made only when the characteristic skin lesion was evident or its earlier presence could be definitely ascertained by the testimony of patient and physician, though this requirement might, and ultimately did, exclude from our records cases which in all probability were suffering from pellagra without showing evidences of its cutaneous manifestation.

II. Acknowledgments. It is not practicable to make personal acknowledgment in each case to the many physicians to whom we are under great obligations for their interest and coöperation. The Spartanburg County Medical Society supported us in all our work, and we wish to express our high appreciation of its active part in furthering the investigation. Our only way of approaching patients was through their local physicians, and in no case did we find anything but the most ready coöperation on the part of the physicians, while many actively associated themselves in the work at a considerable expenditure of time and effort. In the more intensive studies in selected localities, which will appear in a future report, opportunity will be given us to make acknowledgment of these special services.

We are indebted to Dr. J. W. Babcock for the privilege of consulting with him from time to time during the work, and for many special services, especially for data concerning pellagrins admitted

to the State Hospital for the Insane from Spartanburg County and for pathologic material collected at autopsies in that institution.

To Dr. J. A. Hayne, secretary and health officer of the South Carolina State Board of Health, we are under obligations for his interest and coöperation in our investigations, and particularly for furnishing from his office vital statistics concerning pellagra.

III. **The Territory Selected.** Spartanburg County is situated in the northern or Piedmont section of South Carolina. It is forty miles long in a north-south direction, thirty miles from east to west, and contains 762 square miles. Its surface is hilly and broken by a network of small streams and by four small rivers which, with their tributaries, flow across the county in a southeasterly direction, one of these rivers forming the county line on the south. The elevation above sea level at Spartanburg, the county seat, is 875 feet. To the northwest the slope is upward, the northwest corner of the county being situated at the foot of the Blue Ridge Mountain range, while to the south and east the elevation becomes somewhat lower than at Spartanburg, but with no precipitate fall, the whole county thus resting upon a plateau about 700 feet above sea level.

Table I.—Population Spartanburg County Census 1910.

		Total.	One year.	One to four years.	Five years.	Six to nine years.	Ten to fourteen years.	Fifteen to seventeen years.	Eighteen to nineteen years.	Twenty years.	Twenty-one to forty-four years.	Forty-five years and over.	Unknown.
Total population	..	83,465	2,733	10,091	2,370	8,852	10,402	5,710	3,878	1,870	26,239	11,161	159
	M.	41,719	1,425	5,167	1,171	4,490	5,270	2,840	1,903	893	12,822	5,652	86
	F.	41,746	1,308	4,924	1,199	4,362	5,132	2,870	1,975	977	13,417	5,509	73
Native white—native parents	..	56,536	1,918	6,842	1,587	5,834	6,742	3,874	2,576	1,254	17,677	8,149	83
	M.	28,472	991	3,526	793	2,969	3,464	1,907	1,280	612	8,820	4,063	47
	F.	28,064	927	3,316	794	2,865	3,278	1,967	1,296	642	8,857	4,086	36
Native white—foreign parents	..	309	5	28	8	29	31	27	8	6	111	54	2
	M.	150	2	15	6	11	12	14	3	2	55	30	
	F.	159	3	13	2	18	19	13	5	4	56	24	2
Foreign-born white	..	203	..	1	..	1	4	6	7	5	98	80	1
	M.	136	..	...	..	..	3	5	6	5	64	53	
	F.	67	..	1	..	1	1	1	1	..	34	27	1
Black	..	21,944	637	2,675	635	2,445	3,018	1,486	1,098	506	6,910	2,467	67
	M.	10,893	335	1,338	299	1,244	1,489	762	530	236	3,289	1,335	36
	F.	11,051	302	1,337	336	1,201	1,529	724	568	270	3,621	1,132	31
Mulatto	..	4,466	172	544	140	543	607	316	189	99	1,441	409	6
	M.	2,065	97	288	73	266	302	152	84	38	593	169	3
	F.	2,401	75	256	67	277	305	164	105	61	848	240	3
Indian	..	4	1	1	..	..	...	..	..	..	1	1	
	M.	1	..	...	..	..	...	..	..	..	...	1	
	F.	3	1	1	..	..	...	..	..	..	1		
Chinese	..	2	..	...	..	..	...	..	..	..	1	1	
	M.	2	..	...	..	..	...	..	..	..	1	1	
	F.												
Japanese	..	1	..	...	..	..	...	1					
	M.												
	F.	1	..	...	..	..	...	1					

The annual mean temperature, as recorded at Spartanburg, is 60° F. While the winters are mild, killing frosts are apt to occur from November to March inclusive, and the normal mean temperature for the months of December, January, and February is about 42° F.

The total population of the county is 83,465. Spartanburg, with a population of 17,517, is the only city in the county, the remaining population (65,948) being distributed upon farms, in cotton-mill villages, and among eleven small towns, only two of which have over 1000 inhabitants. The density of population, as a whole, is 109 per square mile; for the rural population (that is, outside of Spartanburg City) it is 86.5. While in South Carolina, as a whole, the negroes form 55 per cent. of the total population, in Spartanburg County the whites predominate numerically in the proportion of somewhat over two whites to one negro—there being a white population of 57,055, and 26,410 negroes—the percentage being 68.4 per cent. whites and 31.6 per cent. negroes. The distribution of the population of the county by race, nativity, age, and sex, according to the United States Census of 1910, is set forth in greater detail in Table I.

The chief industry, and almost the only industry conducted upon a large scale, is that connected with the cotton mills. There are about twenty-eight cotton mills in the county, each mill supporting its mill-village. These mills give employment to approximately 10,000 operatives, representing about 4000 families, and a total mill-village population of about 20,000. As the mill operatives are whites exclusively, it follows that something over 35 per cent. of the white population of the county is found in the mill-villages and is supported by the cotton-mill industry. The mill-village population contains no foreign element, but is drawn altogether from the general native-born population of South Carolina, North Carolina, Tennessee, Kentucky, Georgia, and other nearby States. An effort is made by the mill operators to secure families with the maximum number of individuals capable of employment as operatives. The income of the mill workers ranges from about 75 cents per day to \$2 or even more, averaging about \$1.25 per day.

The chief agricultural pursuit throughout the county is cotton culture, though in recent years more and more land has been turned over to corn and other grain crops. The average value of farm lands, \$36.04[2] per acre, is considerably above that found in many sections of the Southern States.

IV. PREVALENCE OF PELLAGRA IN THE COUNTY. Altogether, 282 cases of pellagra were studied in detail during the period the commission was working in the county, that is, from June 1 to

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[2] United States Census Bureau.

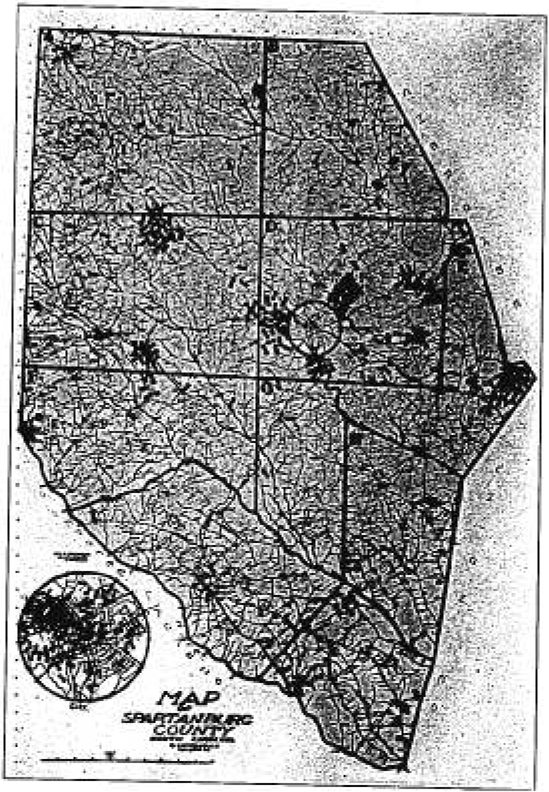
October 15, 1912, and these 282 cases are the basis for the greater part of our study. For the purposes of certain special lines of inquiry, such as the history of pellagra in the county, the geographic distribution of the disease at different periods, the sequence of cases in different local areas, and the possible increase or subsidence of the malady with regard to both frequency and virulence, records were secured of cases known to the physicians of the county, but which had died or moved beyond the county limits. It should be said also that the 282 cases on our list as present in the county in 1912 represent the minimum figures for the county in this period.

Accepting 282 as the minimum number of cases, we have in Spartanburg County, in 1912, a minimum morbidity rate for the population, as a whole, of 0.35 per cent. or 35 cases of pellagra for each 10,000 of the population.

Including 94 additional cases of which we secured definite knowledge in the county in 1912, but were not able to visit, usually because of their early death or their commitment to the State Hospital, the total number of cases in the county becomes 376, or 44.9 per 10,000 of population. We believe this rate represents very nearly the actual prevalence of pellagra in 1912 in the territory studied.

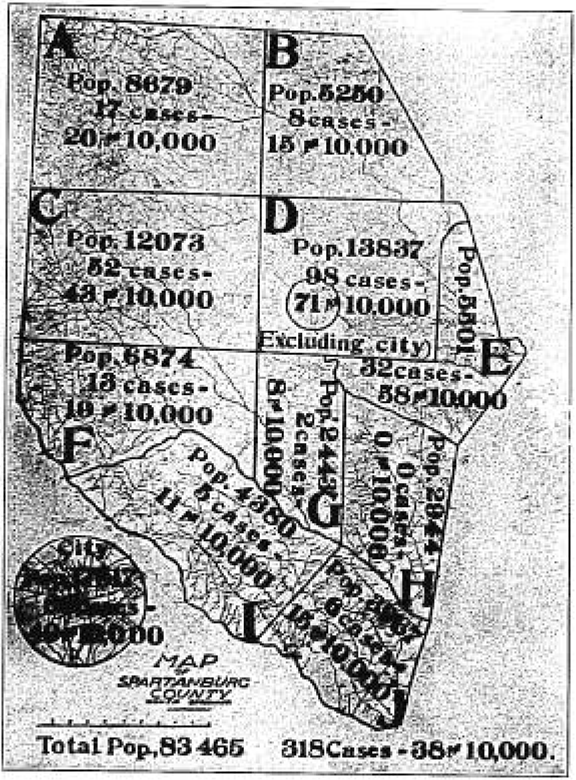
In view of the fact that this rate is considerably higher than has previously been reported in any single territory of like area, it should be distinctly understood that in no other territory in the United States has so intensive a study been made and pellagrins so thoroughly sought out. Abundant evidence was gathered that the disease is at least equally prevalent in adjoining counties of South Carolina and in certain parts of adjoining States. Furthermore, in Lavinder's extensive compilations of statistics of pellagra in 9 Southern States, 4 States show a greater number of cases than does South Carolina, and 2 States a higher rate per 10,000 of population. Referring to Spartanburg County, Lavinder justly recognizes the exceptional interest displayed by the physicians of the county in the disease, and considers his reports from this county to be exceptionally complete. He was able to get reports of 226 cases up to the beginning of 1912. Our more intensive search, confined to the one county, discovered a total of 398 cases prior to 1912. The difference of 172 cases might be considered surprisingly small were it not for the unquestionable fact that the reports obtained by Lavinder from Spartanburg County were exceptionally complete. There can be no question that the excessive number of cases for Spartanburg County, which appears in both Lavinder's figures and ours, represents more complete returns, and not a greater prevalence of pellagra than is present in other localities from which reports are less satisfactory.

V. GEOGRAPHICAL DISTRIBUTION OF PELLAGRA WITHIN THE COUNTY. In order first to investigate the possibility of any geographical inequality in the distribution of the disease within the bounds of the county itself, we have considered the incidence of the disease in each of its ten townships separately.



MAP 1.—Geographical distribution of cases in county and city of Spartanburg in 1912.

By referring to Map 2 it is seen that the township rate per 10,000 of population ranges from no cases in township H to 71 cases per 10,000 of population in township D. It is noteworthy, further, that the three townships C, D, and E, stretching across the middle of the county, give rates of 43, 71, and 58 cases respectively, or a combined average of 55 per 10,000; while townships



Map 2.—Distribution of cases by townships with rate per 10,000 of population.

A and B to the north and F, G, H, I, and J to the south give 20, 15, 19, 8, 0, 11, and 15 respectively and a combined average of only 14 per 10,000.

The incidence rate of pellagra within the city of Spartanburg was 49 per 10,000, considerably lower than the total rate (58) for township D, in which it is situated. The combined average rate of townships C, D, and E, exclusive of Spartanburg City, is 58 against only 14 in the remaining townships.

The population of the county may be still further divided geographically into three parts: (1) the rural population; (2) the mill-village population; (3) the urban population of Spartanburg City. The rural population is found upon the farms and in eleven small towns, one of which has 1880 inhabitants, another 1101, and the remaining nine from 100 to 500 or 600.

Approximately one-fourth of the population of the county live in the cotton-mill villages. There are twenty-eight of these villages in the county, their individual population ranging from about 200 to about 2000. Within the city of Spartanburg there are two mill-villages, with a joint population of approximately 2950, the remaining 14,567 constituting the city population proper. Such a distribution of the population affords an opportunity to carry farther the analysis of the geographic distribution within the territory of each township by considering separately the prevalence of the disease among the rural, urban, and mill-village population respectively. The results of this analysis are shown in Table II and are graphically displayed by Chart 1.

TABLE II.—Rural, Mill-village, and Urban Distribution of Cases by Townships.

Township.	Total population.			Rural population.			Mill-village population.			Excess in mill-village over rural population.
	Population.	Cases of pellagra.	Rate per 10,000.	Population.	Cases of pellagra.	Rate per 10,000.	Population.	Cases of pellagra.	Rate per 10,000.	
A	8,679	17	20	8,179	13	15	500	4	80	65
B	5,250	8	15	4,650	7	13	600	1	17	4
C	12,073	52	43	9,173	17	20	2,900	35	121	101
D[3]	13,837	98	71	7,504	21	28	6,333	77	120	92
E	5,501	32	58	2,751	8	29	2,750	24	87	58
F	6,874	13	19	6,174	8	13	700	5	71	58
G	2,443	2	8	2,443	2	8	0	0	0	
H	2,944	0	0	2,944	0	0	0	0	0	
I	4,380	5	11	3,580	3	8	800	2	25	17
J	3,967	7	18	2,967	4	13	1,000	3	30	23
City	17,517	85	49	(14,567[4])	(43[4])	(29[4])	2,950	42	142	113
County	83,465	319	38	50,365	83	16	18,533	193	104	88

With one exception, in each of the eight townships with a mill-village population, the prevalence of pellagra among the mill-villages is markedly in excess of its prevalence among the rural population, this excess ranging from 17 per 10,000 in township I to 101 per 10,000 in township C, and reaching even a still higher figure (113) in the city of Spartanburg. In the county, as a whole, the mill-village population shows an excess of 50 per 10,000 over the total county average and of 88 per 10,000 over the rural districts alone. The apparent exception presented by township B, in which the excess among the mill-village population was only 4, disappears in view of the fact that the one mill in that township had been in operation only a month or so. The rate per 10,000 in the urban population of Spartanburg City, exclusive of the mill-village population of the city, is about equal to the combined rate among the rural population of townships C, D, and E, exclusive

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[3] Exclusive of city.

[4] City population exclusive of mill-village.

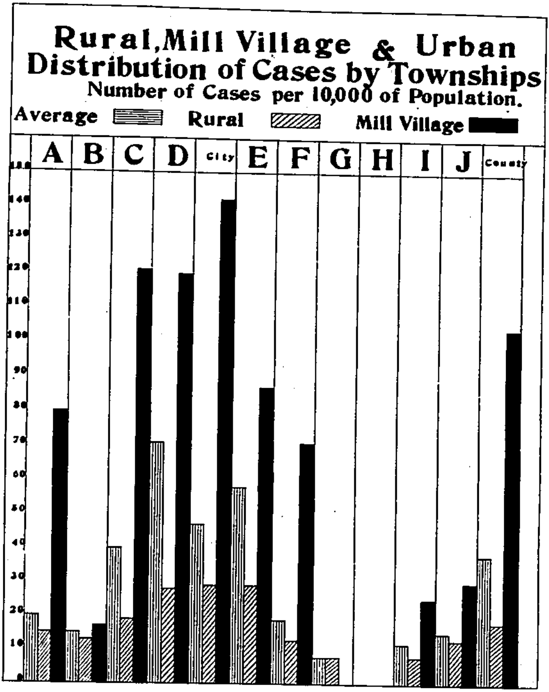

CHART 1.

of their mill-village population, while the mill-village population in Spartanburg City (2950) shows 142 per 10,000, the maximum rate in our figures.

Excluding both urban and mill-village population, and considering the rural population alone, we find that the three townships C, D, and E still show a prevalence of pellagra twice that of the remainder of the county, the combined average rural rate for these townships being 24 per 10,000, while for the rural population of the remainder of the county it is only 12.

There are two factors which may possibly offer an explanation of this difference. In the three townships (C, D, and E) showing the excessive rate, with a total population of 19,428, the mill-village population (9833) makes up 50 per cent. of the total population (excluding the city of Spartanburg), while in the remainder of the county, with a total population of 30,937, the mill-villages have a population of only 3600, or 12 per cent. of the whole. It might be supposed that a large mill-village population showing a relatively high prevalence would tend to increase the prevalence of the disease in the surrounding rural districts.

The apparent fact that cases of pellagra are excessively prevalent in the mill-villages where the population is congested, suggests the question whether the congestion of population itself may not have an important influence upon the incidence of the disease. The average density of population for the county as a whole is 109 per square mile, while for the rural districts, exclusive of Spartanburg City, it is 86.5. For the rural population, exclusive of the mill-villages, it is 60.3. In the three townships C, D, and E, which show a striking excess of pellagra among the rural population compared with the rural population of the eight other townships, the density of rural population is 72 per square mile, and in the remaining townships it is only 56, a difference in density of 16 per square mile. While the greater density of population in townships C, D, and E might be a causative factor in the greater prevalence of pellagra in the rural population of those townships, the rate of prevalence does not vary strictly as the relative density of population in each township, though it shows some tendency to do so.

Further evidence that density of population alone is not accountable for the greater prevalence of the disease in mill-villages is found within Spartanburg City itself. There the mill-villages, which are continuous with and an integral part of the city, present a rate of 142 per 10,000, whereas the remainder of the city population, living under approximately the same condition of congestion, gives only 29 per 10,000. Furthermore, the non-mill-village population within the city, with a density which is certainly over 3000 per square mile, shows almost exactly the same prevalence of pellagra per 10,000 as does the strictly rural population of the surrounding township, with only 90 inhabitants per square mile.

These figures would seem to indicate that while congestion of population may play a part in the prevalence of the disease, it alone does not explain the marked inequality of distribution between the mill-villages and the strictly rural population.

VI. Racial Distribution. The distribution of the cases of pellagra in the county between the races presents a second marked inequality. While in South Carolina as a whole the number of whites and negroes is about equal, the negroes being slightly in excess, in Spartanburg County the whites predominate numerically in about the proportion of two to one, the actual figures being, whites 57,055, negroes 26,410 (Table III). The 57,055 whites gave 257 cases of pellagra, or at the rate of 45 per 10,000; the 26,410 negroes gave 25 cases of pellagra, or at the rate of 9.5 per 10,000. In other words, while whites are present in the population in the proportion of two whites to one negro, there are ten white pellagrins to one negro pellagrin.

One fact of fundamental importance in the racial comparison is the practical absence of negroes from the mill population. It follows that a more accurate comparison between the races can be made by comparing the rate of prevalence among negroes with the rate among whites, exclusive of the mill population. We have seen that the rate among the total population, exclusive of the mill-villages, was 18 per 10,000. Subtracting the negro population and the negro pellagrins we have remaining a white population, exclusive of mill-village population, of 38,522, which gave 97 cases of pellagra, or 25.2 per 10,000 against 9.5 per 10,000 among the negroes. In other words, in Spartanburg County the disease appears to be 4.7 times as prevalent among all whites as among negroes, and 2.6 times as prevalent among whites, exclusive of the cotton mill-villages.

Table III.—Distribution of Pellagrins among Whites and Negroes.

	Population.	Cases of pellagra.	Rate per 10,000.	Excess of whites over negroes per 10,000 of population.
All whites	57,055	257	45.0	35.5
Whites outside of mill-villages	38,522	97	25.2	15.7
Negroes	26,410	25	9.5	

The racial incidence was carefully investigated with a view to determine whether the racial variation might be due to failure to discover cases of pellagra among negroes as readily as among whites. The practising physicians throughout the county were questioned as to the comparative prevalence among the negroes in their particular section, and as to its comparative prevalence in this race in the past. Without exception we were informed that pellagra in negroes was of comparatively infrequent occurrence. In this connection it is well to state that many of these physicians have lived and practised medicine in the same place for many years; that they are personally acquainted with practically the entire population in their particular field of work, both whites and negroes, and that they are in general thoroughly capable of correctly diagnosticating the disease.

The two colored physicians in Spartanburg were closely questioned as to the occurrence of pellagra in their practice at present and in the past, and the cases cited by them are included in our statistics. Furthermore, the information furnished by them relative to the occurrence of cases in the past is in accord with these statistics. When negroes suffering with pellagra were visited a particular effort was made to secure from them information as to the occurrence of the disease in others of their own race. A number of names were secured in this way, and many negroes suspected of having the disease were visited. Many of the planters owning large plantations and having as tenants or laborers a large number of negroes were closely questioned as to the prevalence of the disease, and in some instances canvasses were made. Notwithstanding the efforts made to discover the disease in negroes, it was impossible to find more than twenty-five cases.

It is not believed that the number of cases overlooked could materially alter the relative incidence of nearly five cases in whites to one in negroes, and the racial variation is evidently a real one, though it may possibly be explained in part by the absence of negroes from the mill-village population, which, as we have seen, shows a marked excess of pellagra compared with the remainder of the white population.

TABLE IV.—Racial Distribution of Population and Racial Distribution of Pellagra with Percentages.

State.	Population statistics.[5]				Pellagra statistics.					
	White.		Negro.		White.		Negro.		Pellagra per 10,000 of population.	
	Number.	%	Number.	%	No.	%	No.	%	W.	N.
Virginia	1,389,809	67.4	671,096	32.6	476	76	152	24	3	2
North Carolina	1,500,513	68.0	697,843	31.6	1744	81	407	19	12	6
South Carolina	697,162	44.8	835,843	55.2	1129	71	471	29	16	6
Georgia	1,431,816	54.9	1,176,987	45.1	3127	80	741	20	22	6
Kentucky	2,027,951	88.6	261,656	11.4	442	92	39	8	2	4
Alabama	1,228,832	57.5	908,282	42.4	1138	58	813	42	9	9
Mississippi	786,119	43.7	1,009,487	56.6	1387	55	1156	45	18	11
Louisiana	941,086	56.8	713,874	43.1	338	56	269	44	4	4

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[5] Population statistics are those of the Thirteenth Census (1910). The pellagra statistics were compiled from those reported by Lavinder in reprints from Weekly Public Health Reports, No. 106.

Table No. IV is an analysis of population by race, and of the incidence of pellagra by race for eight Southern States. The pellagra statistics in this table were secured by correspondence and, as Lavinder states, are very incomplete.

In Spartanburg County there is a marked difference in racial incidence, but any suggestion that this depends upon the factor of race alone may seriously be questioned. In Table IV it may be seen that the case incidence in the two races in the States of Alabama and Louisiana shows little difference; while in South Carolina and Georgia, and to a less extent in North Carolina, there is a marked preponderance in whites. It is possible that industrial conditions in these States account largely for this variation.

VII. SEX DISTRIBUTION. The population of the county is divided practically equally between males and females, the females being only 27 in excess. The total male population of 41,719 gave 71 cases of pellagra, or at the rate of 17 per 10,000. The female population gave 211 cases, or at the rate of 50.5 per 10,000 (Table V). In other words, pellagra appears nearly three times more frequently among females than among males. Among the white population alone this proportion between males and females remains about the same, while among the negroes the relative prevalence among males and females is nearly four females to one male. This inequality between the sexes is brought out more strikingly and in greater detail if the figures are analyzed by dividing the population according to age.

TABLE V.—Distribution by Sex.

		Number in population.[6]	Cases of pellagra.	Rate per 10,000.	Excess per 10,000 among females.
Whites:	Male . .	28,758	66	22.95	
	Female . .	28,290	191	67.5	44.5
Negroes:	Male . .	12,958	5	3.9	
	Female . .	13,452	20	14.9	11.0
Both races:	Male . .	41,716	71	17.0	
	Female . .	41,742	211	50.5	33.5
Total population . .		83,458[6]	282	33.8	

TABLE VI.—Age Distribution of Two Hundred and Eighty-two Cases.

Age.	Total population.[7]	Cases of pellagra.	Rate per 10,000.
0 to 5	15,194	21	10.8
6 to 9	8,852	22	24.9
10 to 19	21,860	28	12.8
20 to 44	26,239	158	60.2
45+	11,161	53	47.5

[6] Exclusive of 4 Indians, 2 Chinese, and 1 Japanese.

[7] Exclusive of 159 persons of unknown age.

VIII. Age Distribution. First, considering the prevalence of pellagra according to age, without reference to sex, we find the inequalities shown in Table VI, and graphically presented in Chart 2.

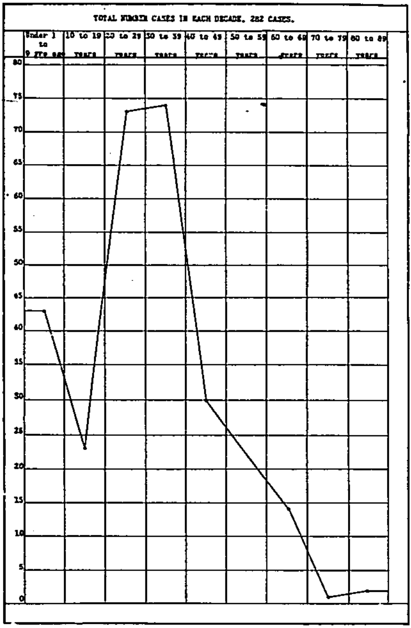

Chart 2.—Total number of cases in each decade.

In this and the following tables dealing with age distribution, in which the prevalence of pellagra is expressed in rate per 10,000 of the population, our age groups are necessarily made to conform to the age statistics for the population of Spartanburg County which could be secured from the United States Census Bureau—namely, the population of the county under six years of age, from six to nine years, ten to nineteen years, twenty to forty-four years, and forty-five years or older. The actual number of cases in these groups means little because of the wide difference in the size of the groups, both with regard to the number of years and the number of individuals concerned. A striking excess in the rate of prevalence is apparent in the group twenty to forty-four years of age (60.2 per 10,000). The rate among those over forty-four years of age is much higher than in any other group excepting that between twenty and forty-four years. These two groups taken together, that is, the entire population over nineteen years of age compared with the entire population under twenty years of age gives the following result: Twenty years and older, 211 cases, or 56.4 per 10,000; nineteen years and younger, 71 cases, or 15.5 per 10,000.

Dividing the younger group we find that children under ten years of age gave a total of 43 cases, or 17.9 cases per 10,000; those from ten to nineteen years of age gave 28 cases, or 12.8 per 10,000. Furthermore, this higher prevalence for children under ten years is found entirely among the children between the ages of five and ten years who alone gave a rate of 24.9 per 10,000, while the younger group under five years of age gives only 10.8 per 10,000, the lowest rate found in any group.

In Chart 2 the distribution of pellagra by the number of cases in each age group is shown, dividing the cases into age decades. By comparing this chart with Table VI it is evident that the curve would be considerably modified if it expressed the rate per 10,000 of population instead of the actual number of cases in our figures. The prevalence among children under ten years would not be quite so high compared with that in other groups. The relative prevalence in groups over forty years would be higher. The two groups of from twenty to forty years would still show a striking excess over all other decades. It may be said here that the marked fall in the prevalence of pellagra in the groups ten to nineteen years appears throughout our statistics, and will come out strikingly in the consideration of the family distribution of the disease.

IX. Distribution by Age and Sex. It is important to ascertain whether the excessive prevalence of pellagra among females holds in all ages of the population, and whether the excessive prevalence found in certain age groups, notably those from twenty to forty-five years, is to be found among both males and females. Referring to Table VII it may be seen that the excess among females is not the same among all ages of the population, but is confined largely to those between the ages of twenty and forty-four years. Further, under ten years of age males and females show practically the same prevalence of pellagra. From ten to nineteen years the females show a rate a little over twice that of the males; in the large group of from twenty to forty-four years the females show a rate per 10,000 over nine times greater than the male rate. Among the population of forty-five years and over the distribution between the sexes is again nearly equal.

These cases have been further analyzed by decades, with the result as represented graphically by curves in Chart 3. These curves express actual number of cases.

Table VII.—Distribution by Age and Sex.

Age.	Sex.	Population.	Number of cases.	Rate per 10,000.	Excess per 10,000.
Under 5	M.	7,763	10	12.9	
	F.	7,431	11	14.8	1.9
5 to 9	M.	4,490	12	27.0	
	F.	4,364	12	27.5	0.5
10 to 19	M.	10,906	7	6.4	
	F.	10,951	16	14.6	8.2
20 to 44	M.	12,822	16	12.5	
	F.	13,417	148	110.3	97.8
Over 44—	M.	5,652	25	44.2	
	F.	5,509	27	49.0	4.8

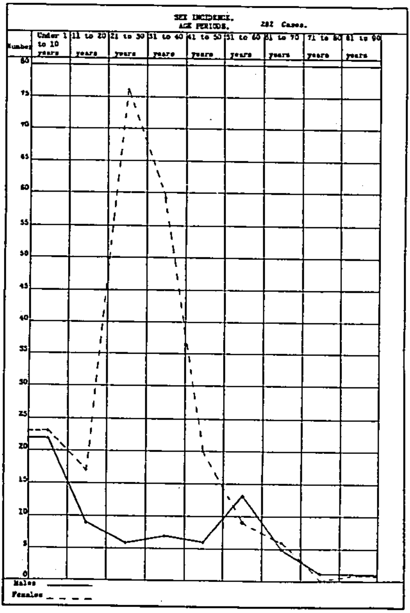

Chart 3.—Distribution by age and sex.

The fall in the curve in the second decade of life is present for both sexes, but is more marked for males. Thereafter the male curve continues to fall, whereas the female curve rises to its highest point in the following decade (twenty-one to thirty years), drops slightly among women of thirty-one to forty years, then falls abruptly in the next decade (forty-one to fifty years) to a point somewhat below both males and females under ten years. In the decade of from fifty-one to sixty years the female curve continues to fall, and for the first time descends below the male curve, which shows a slight rise. Thereafter the number of cases is small and the two curves fall together.

The data expressed in Table VII and Chart 3 may be summarized as follows: Pellagra appears to be about equally prevalent among males and females under ten years of age and over forty-five years. Males alone show the highest prevalence in children under ten years. Females show a strikingly higher prevalence in the two decades of twenty to thirty and thirty to forty years than does either sex in any other decade.

Table VIII indicates in a general way that both whites and negroes separately show practically the same inequalities in the distribution of pellagra between the sexes in the different age groups, as has been shown in considering both races together. Any closer analysis of the figures for the two races is unsatisfactory, owing to the small number of negro cases in each age group.

TABLE VIII.—Race, Age, and Sex Incidence (Two Hundred and Eighty-two Cases).

Age.	Whites, 257 cases.		Negroes, 25 cases.	
	Male.	Female.	Male.	Female.
Under 1 to 5	9	11	1	0
Under 6 to 10	12	11	0	1
Under 11 to 20	9	14	0	3
Under 21 to 30	4	65	2	11
Under 31 to 40	6	56	1	3
Under 41 to 50	6	20	0	0
Under 51 to 60	14	9	0	0
Under 61 to 70	4	5	1	1
Under 71 to 80	1	0	0	0
Under 81 to 90	1	0	0	1
Totals	66	191	5	20

While it is not proposed to enter into any extensive comparative studies in this preliminary report, there are certain data upon the age and sex distribution of pellagra in this country which present an interesting parallel with the figures for Spartanburg County.

Chart 4 represents by curves based on actual number of cases the age and sex distribution of 164 cases of pellagra, 99 of which were reported by Mizell,[8] of Georgia, and 65 by Tucker,[9] of Virginia.

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[8] From paper read at the Second Triennial Meeting of the National Association for the Study of Pellagra, Columbia, S. C., October 3, 1912.

[9] Beverley R. Tucker, M.D., A Discussion of Pellagra, with Remarks on Sixty-six Cases Occurring Outside of Institutions, Old Dominion Jour. Med. and Surg., April, 1911, vol. xii, No. 4.

Chart 5 shows mortality rates for the State of Texas. This chart was furnished to us by Dr. H. K. Beall, of Fort Worth, Texas,[10] who first directed attention to the inequalities of distribution by age in males and in females.

Chart 6 is based upon death reports of pellagra in Alabama between June, 1909, and December, 1912. These reports cover a total of 1148 cases during this period. The data were kindly supplied by Dr. W. H. Sanders and Dr. H. G. Perry, of the Alabama State Board of Health.[11]

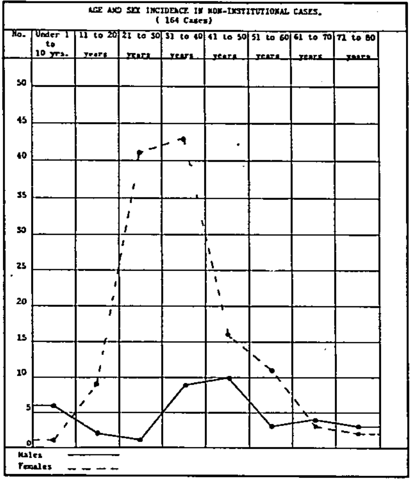

CHART 4.—Age and sex incidence in non-institutional cases.

Chart 7 presents a graphic representation of mortality rates for pellagra in the State of North Carolina for 1911 and 1912. We have to thank the health authorities of North Carolina for the information on which this chart is based.[12]

The data from these five sources are all the statistics available to us at the present time which lend themselves to a comparison with our own figures regarding age and sex distribution. It should be noted that the curves in Chart 4, like our own, are based on morbidity statistics, while Charts 5, 6, and 7 are based upon death reports.

[10] Personal communication.

[11] Ibid.

[12] Ibid.

A comparison of the four charts shows considerable variation in both the male and the female curves in different age groups.

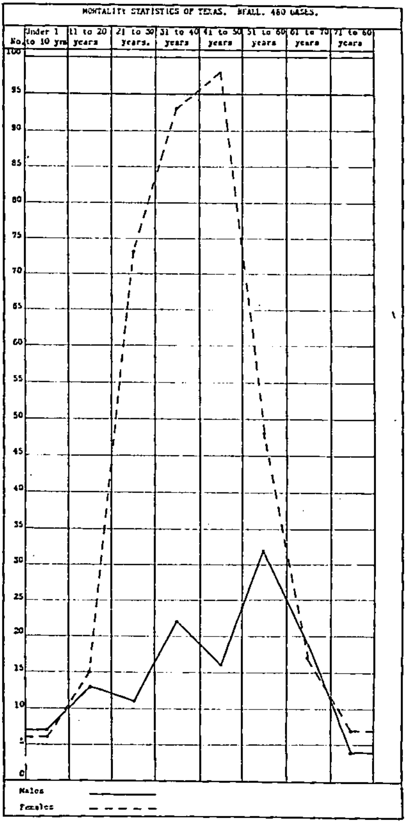

CHART 5.—Mortality statistics of Texas.

They all agree, however, in showing a strikingly excessive prevalence among females of middle age and a comparative equality of distribution between males and females in childhood and among people of advanced age.

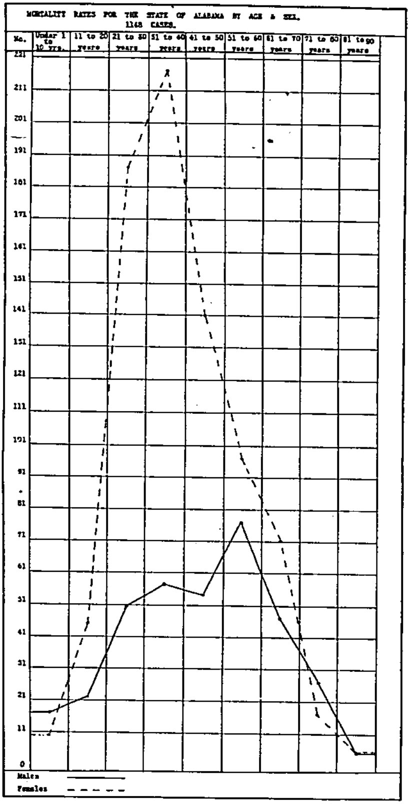

CHART 6.—Mortality rates for the State of Alabama by age and sex.

X. DISTRIBUTION BY OCCUPATION. The consideration of the relationship between occupation and the incidence of pellagra in Spartanburg County resolves itself almost entirely into a discussion of the relative prevalence of the disease among field laborers, workers in the cotton-mills, and those engaged in housework. Only a few scattered cases gave other employment. The actual data with regard to occupation obtained from 234 cases of pellagra is set forth in Table IX: 110 (47 per cent.) gave housework as their occupation exclusively; 14 others (6 per cent.) gave housework as their chief employment; 16 (6.8 per cent.) were employed in housework part of the time, working the remainder of the time in the mills; 18 (7.7 per cent.) worked alternately about the house and in the fields. Thus a total of 158 (67.5 per cent.) of the 234 cases, were employed in household work within the home for at least a fair portion of their time. These figures mean little more than what has already been shown by the age and sex distribution of the disease—namely, that it is excessively prevalent among adult females the great majority of whom are employed in housework. There is one further indication, however, that pellagra has a much higher prevalence among the adult females of the mill-villages who are occupied as housewives than among those who work in the mills, and this point may be more closely examined by considering the occupational distribution of pellagra in the mill population alone.

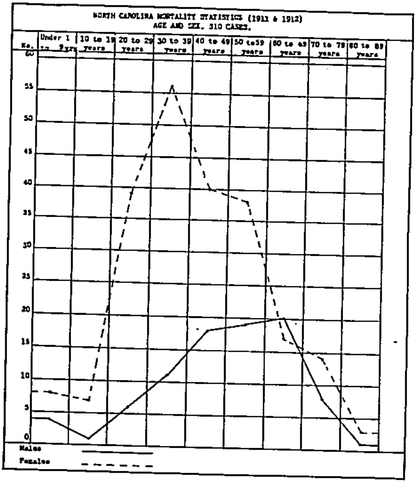

CHART 7.—North Carolina mortality statistics during 1911 and 1912.

TABLE IX.—Distribution of Two Hundred and Thirty-four Cases of Pellagra by Occupations.

Occupation.	Males.	Females.	Both sexes.	Per cent. of total.
Farmers	14	..	14	6.0
Field work and housework	..	18	18	7.7
Mill work exclusively	21	20	41	17.5
Mill work, some housework	..	16	16	6.8
Housework exclusively	..	110	110	47.0
Housework chiefly, some mill work	..	14	14	6.0
Scattering[13]	9	3	12	5.1
No occupation	2	7	9	3.8

There are available for this study 121 cases of pellagra of working age residing in mill-villages. Of these, 24 were males and 97 females; 21 (87.5 per cent.) of the 24 males were mill operatives. Of the 97 females, 12 (only 12.37 per cent.) worked in the mills exclusively; 16 additional female cases worked in the mills the greater part of the time, making a total of 28 female mill workers (or 28.86 per cent.) of the 97.

46, or very nearly half (47.42 per cent.) of the 97 women did no mill work, devoting themselves to housework exclusively; while 14 others were chiefly employed in housework, going to the mills only occasionally, making a total of 60 houseworkers, or 68.85 per cent. of the female pellagrins of working age living in the mill-villages.

We have no actual statistics regarding the proportion of males and females among mill operatives. It would seem perfectly safe to say that there are at least as many females as males, the probabilities being that they are in a considerable majority. As a rule, female operatives are preferred by the mill operators. Assuming equality between the sexes among mill workers, as may surely be done with safety, the data above presented has a highly important significance, in that it shows a nearly equal prevalence of pellagra in males and females who are employed in the mills as operatives—namely, 17 males and 12 females—if we include only those women doing mill work exclusively, and 28 females if we include the 16 who gave mill work as their chief but not exclusive occupation. This comparative equality as regards the prevalence of pellagra between the sexes among mill operatives is in striking contrast to the inequality between adult males and females in our sex statistics for the population as a whole, and is very closely in harmony with what is known of sex distribution in institutional cases where a difference in prevalence between the sexes is absent or slight.

In comparing the mill-village population with the rural population as regards the prevalence of pellagra, we found the disease nearly seven times as prevalent in the mill-villages as in the rural districts, the actual rate of prevalence in the mill population being 104 per 10,000. Out of the total mill-village population of approximately 19,000, about one-half, or 9500, are actually employed in the mills. Among these mill operatives we have 57 cases of pellagra, including those patients who gave mill work as their chief but not exclusive occupation. These 57 cases give a rate of 60 per 10,000 among actual mill operatives, against 104 per 10,000 for the total mill-village population. The 41 patients giving a history of mill work exclusively present a rate of only 43.2 per 10,000. These figures seem to indicate that the excessive prevalence of pellagra in the mill-village population is not found among those who actually work in the mills, but among the women engaged in the day about the houses, and the children who are at home with them.

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[13] Two patients were merchants, two dressmakers, one was employed in each of the following occupations: insurance, student, carpenter, butcher, clerk, railroad fireman, day laborer, school teacher.

While children under working age do not form a part of an occupational study, it may well be noted in this connection that 30 mill-village children under ten years of age had pellagra. These cases added to the 60 adult females in the mill-villages engaged in housework exclusively make a total of 90 cases of pellagra in the mill-village population of the county, which by occupation were about the dwellings during the day, against 57 cases among the population engaged in mill work. The 57 operatives give a rate of 60 per 10,000 for the half of the mill-village population which works in the mills. The 90 houseworkers and children give a rate of 94.7 per 10,000.

XI. Distribution of Cases in Families. 316 cases of pellagra are available in our data for a study of family and household relationships, and these cases represent 223 families, an average of 1.42 cases of pellagra per family. An analysis of the family distribution is given in Table X. About half the total number of cases occurred singly in families, and about one-fourth of the total number occurred two to a family. Of the total number of families with pellagra (223) nearly three-fourths (160) had but one case, and nearly one-fifth gave but two cases. Nearly one-tenth of the families gave 3, 4, or 5 cases.

In view of the inequalities found in the prevalence of pellagra in the two sexes, and at different ages, an attempt has been made to discover whether the sex and age distribution differs among cases which occur singly in families from the distribution among cases occurring two or more to a family—in other words, to determine whether cases developing singly in families are apt to be of any particular age or sex, and to differ in these respects from multiple family cases. For this purpose, 294 cases for which age and sex statistics are available have been charted (Chart 8) by age periods of five years each—cases occurring singly in families being represented by a solid line, and cases occurring two or more to a family by a broken line. The upper two curves represent male cases alone; the middle curves, females alone; and the lower curves, the two sexes combined. The curves represent the percentage of the total 294 cases and not the actual number of cases in each group. Accordingly, the solid line and the broken line would coincide wherever the same condition of distribution exists between single cases and cases occurring two or more to the family.

TABLE X.—Distribution of Pellagra in Families.

	Number of families.	Number of cases.	Percentage of total number of families.	Percentage of total number of cases.
One case to one family	160	160	71.7	50.6
Two cases to one family	42	84	18.8	26.6
Three cases to one family	14	42	6.3	13.3
Four cases to one family	5	20	2.3	6.3
Five cases to one family	2	10	0.9	3.2
Total with more than one case to one family	63	156	28.3	49.4

The most striking inequality between the two curves is present among children under ten years of age. Not only is the curve for multiple family cases higher than the curve for single cases in both males and females, but for males alone and for the combined sexes it goes higher among children under ten years than in any other age group. In this respect it presents a striking contrast to the curve for single family cases and to our general age distribution. It is remarkable, further, that this excessive prevalence in multiple family cases is much greater among males than among females, especially in the younger group of children under six years of age. Among cases occurring singly in families the curve never goes above 5 per cent. in any age group under twenty years among males, females, or the sexes combined. These facts seem to show that where single cases of pellagra occur in families it is rarely children under ten years who are the ones attacked. Among families with more than one case, however, children under ten years form a higher percentage of the cases than does any other decade. Among families with but one case it would appear that the two decades from twenty-one to forty years give the great majority of cases among females, while among males more single cases occur among those over fifty years.

When considering the subject of age and sex distribution, attention was called to the striking fall of prevalence apparent among persons from eleven to twenty years old. Inspection of the curves in Chart 8 shows this fall to be confined almost entirely to cases which occur two or more per family, the indication being that isolated cases in families are as apt to arise among individuals from eleven to twenty years of age as among children under eleven years.

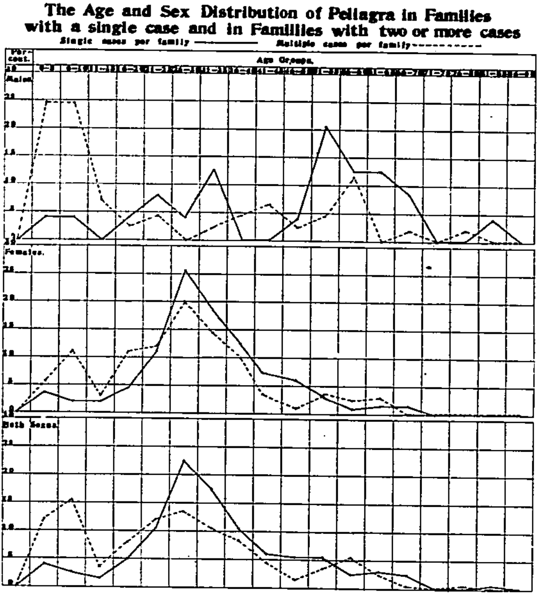
The Age and Sex Distribution of Pellagra in Families with a single case and in Famililes with two or more cases

Chart 8.

It is not considered advisable to proceed farther at the present time in an analysis of the family relationships of pellagrins. Such further investigation would carry us into a study of each individual family, the actual sequence of cases in each family, and, furthermore, would introduce the whole subject of household association and its significance with regard to the family relationship. As yet our data are not sufficiently complete to make such a study in a satisfactory manner. It may be said, however, that while there is some evidence in our preliminary investigation that family relationship *per se* does seem to have some influence upon the incidence of pellagra, there are stronger indications that household association is a more important factor in the distribution of the disease.

(To be concluded.)